

# ORDER FOR SUPPLIES OR SERVICES

PAGE 1 OF 10 PAGES

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

1. DATE OF ORDER 08/28/2012		2. CONTRACT NO. (If any) EP-C-11-037		6. SHIP TO: a. NAME OF CONSIGNEE CPOD	
3. ORDER NO. 0003		4. REQUISITION/REFERENCE NO. PR-ORD-12-02286			
5. ISSUING OFFICE (Address correspondence to) CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268				b. STREET ADDRESS US Environmental Protection Agency Cincinnati Procurement Op. Division 26 West Martin Luther King Drive	
				c. CITY Cincinnati	e. ZIP CODE 45268
7. TO: (b)(4)				f. SHIP VIA	
a. NAME OF CONTRACTOR TETRA TECH EM INC				8. TYPE OF ORDER	
b. COMPANY NAME				<input type="checkbox"/> a. PURCHASE <input checked="" type="checkbox"/> b. DELIVERY REFERENCE YOUR: Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated.	
c. STREET ADDRESS 1881 CAMPUS COMMONS DRIVE SUITE 200 (b)(4)				Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.	
d. CITY RESTON		e. STATE VA	f. ZIP CODE 201911519		
9. ACCOUNTING AND APPROPRIATION DATA See Schedule				10. REQUISITIONING OFFICE CPOD	

11. BUSINESS CLASSIFICATION (Check appropriate box(es)) <input type="checkbox"/> a. SMALL <input checked="" type="checkbox"/> b. OTHER THAN SMALL <input type="checkbox"/> c. DISADVANTAGED <input type="checkbox"/> d. WOMEN-OWNED <input type="checkbox"/> e. HUBZone <input type="checkbox"/> f. SERVICE-DISABLED VETERAN-OWNED <input type="checkbox"/> g. WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOSB PROGRAM <input type="checkbox"/> h. EDWOSB				12. F.O.B. POINT Destination	
13. PLACE OF a. INSPECTION Destination		b. ACCEPTANCE Destination		14. GOVERNMENT B/L NO.	
				15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date) 10 Days After Award	
16. DISCOUNT TERMS					

## 17. SCHEDULE (See reverse for Rejections)

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Tax ID Number (b)(4) DUNS Number: Thriving with Coal in an Environmentally-Constrained World TOPO: William Yelverton Continued ...					

SEE BILLING INSTRUCTIONS ON REVERSE	18. SHIPPING POINT		19. GROSS SHIPPING WEIGHT		20. INVOICE NO.		17(h) TOTAL (Cont. pages)
	21. MAIL INVOICE TO:						
	a. NAME RTP Finance Center						\$170,845.00
	b. STREET ADDRESS (or P.O. Box) US Environmental Protection Agency RTP-Finance Center (D143-02) 109 TW Alexander Drive						\$170,845.00
c. CITY Durham		d. STATE NC	e. ZIP CODE 27711				17(i) GRAND TOTAL

22. UNITED STATES OF AMERICA BY (Signature)

23. NAME (Typed)  
Camille W. Davis  
TITLE: CONTRACTING/ORDERING OFFICER

**ORDER FOR SUPPLIES OR SERVICES**  
**SCHEDULE - CONTINUATION**

PAGE NO  
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IMPORTANT: Mark all packages and papers with contract and/or order numbers.

DATE OF ORDER 08/28/2012	CONTRACT NO. EP-C-11-037	ORDER NO. 0003
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ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
0001	<p>Admin Office: CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268 Period of Performance: 08/28/2012 to 09/30/2013</p> <p>THRIVING WITH COAL IN AN ENVIRONMENTALLY CONSTRAINED WORLD Award Type: Cost-plus-fixed-fee Total Estimated Cost: \$(b)(4) Fixed Fee: \$(b)(4) Completion Form</p> <p>Accounting Info: 11-12-C-261E000-203FA7A-2532-12261EC02 8-001 BFY: 11 EFY: 12 Fund: C Budget Org: 261E000 Program (PRC): 203FA7A Budget (BOC): 2532 DCN - Line ID: 12261EC028-001 Funding Flag: Partial Funded: \$44,640.00 Accounting Info: 12-13-C-261E000-301FK8-2532-12261EC028 -002 BFY: 12 EFY: 13 Fund: C Budget Org: 261E000 Program (PRC): 301FK8 Budget (BOC): 2532 DCN - Line ID: 12261EC028-002 Funding Flag: Partial Funded: \$126,205.00</p> <p>The obligated amount of award: \$170,845.00. The total for this award is</p>				170,845.00	

TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H))

\$170,845.00

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>		1. CONTRACT ID CODE		PAGE OF PAGES	
				1 2	
2. AMENDMENT/MODIFICATION NO. 001		3. EFFECTIVE DATE 09/24/2013		4. REQUISITION/PURCHASE REQ. NO. PR-ORD-12-02286	
5. PROJECT NO. (If applicable)		6. ISSUED BY CODE CPOD		7. ADMINISTERED BY (If other than Item 6) CODE	
CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268					
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)		(x)		9A. AMENDMENT OF SOLICITATION NO.	
TETRA TECH EM INC ATTN (b)(4) 1881 CAMPUS COMMONS DRIVE SUITE 200 (b)(4) RESTON VA 201911519				9B. DATED (SEE ITEM 11)	
		x		10A. MODIFICATION OF CONTRACT/ORDER NO. EP-C-11-037 0003	
CODE (b)(4)		FACILITY CODE		10B. DATED (SEE ITEM 13) 08/28/2012	

**11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS**

- ☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended. ☐ is not extended.  
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

**12. ACCOUNTING AND APPROPRIATION DATA (If required)**

See Schedule

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
X	D. OTHER (Specify type of modification and authority) Mutual Agreement between the Parties and Tetra Tech's e-mail dated September 24, 2013

**E. IMPORTANT:** Contractor ☒ is not, ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

**14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)**

Tax ID Number: (b)(4)  
DUNS Number:

The purpose of this modification is to extend the Period of Performance for one (1) month until October 31, 2013 per the request of the contractor. This is a No Cost Extension.  
TOPO: William Yelverton  
LIST OF CHANGES:

Period of Performance End Date changed  
From: September 30, 2013  
To: October 31, 2013

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)	
		Camille W. Davis	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(Signature of person authorized to sign)		(Signature of Contracting Officer)	

## CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED

EP-C-11-037/0003/001

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NAME OF OFFEROR OR CONTRACTOR

TETRA TECH EM INC

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	<p>This is a No Cost change. Delivery: 10 Days After Award Delivery Location Code: CPOD CPOD US Environmental Protection Agency Cincinnati Procurement Op. Division 26 West Martin Luther King Drive Cincinnati OH 45268 USA</p> <p>Payment: RTP Finance Center US Environmental Protection Agency RTP-Finance Center (D143-02) 109 TW Alexander Drive Durham NC 27711</p> <p>FOB: Destination Period of Performance: 08/28/2012 to 10/31/2013</p>				

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>		1. CONTRACT ID CODE		PAGE OF PAGES 1 2	
2. AMENDMENT/MODIFICATION NO. 002		3. EFFECTIVE DATE 10/29/2013		5. PROJECT NO. (If applicable)	
6. ISSUED BY CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268		7. ADMINISTERED BY (If other than Item 6) CODE		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code) TETRA TECH FM INC ATTN (b)(4) 1881 CAMPUS COMMONS DRIVE SUITE 200 (b)(4) RESTON VA 201911519		(x)		9A. AMENDMENT OF SOLICITATION NO.	
				9B. DATED (SEE ITEM 11)	
		x		10A. MODIFICATION OF CONTRACT/ORDER NO. EP-C-11-037 0003	
CODE (b)(4)		FACILITY CODE		10B. DATED (SEE ITEM 13) 08/28/2012	

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. **FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER.** If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

See Schedule

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: <i>(Specify authority)</i> THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES <i>(such as changes in paying office, appropriation date, etc.)</i> SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
X	D. OTHER <i>(Specify type of modification and authority)</i> Mutual Agreement between the Parties and Tetra Tech's e-mail dated October 24, 2013

**14. DESCRIPTION OF AMENDMENT/MODIFICATION** (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Tax ID Number: (b)(4)

DUNS Number:

The purpose of this modification is to extend the Period of Performance through December 31, 2013. This extension is due to the government shutdown. This is a No Cost extension.

TOPO: William Yelverton

LIST OF CHANGES:

Reason for Modification: Extend Period of Performance

Period Of Performance End Date changed

From: October 31, 2013

To: December 31, 2013

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

## CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED

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NAME OF OFFEROR OR CONTRACTOR

TETRA TECH EM INC

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	<p>This is a No Cost extension. Delivery: 10 Days After Award Delivery Location Code: CPOD CPOD US Environmental Protection Agency Cincinnati Procurement Op. Division 26 West Martin Luther King Drive Cincinnati OH 45268 USA</p> <p>Payment: RTP Finance Center US Environmental Protection Agency RTP-Finance Center (D143-02) 109 TW Alexander Drive Durham NC 27711</p> <p>FOB: Destination Period of Performance: 08/28/2012 to 12/31/2013</p>				

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>				1. CONTRACT ID CODE		PAGE OF PAGES	
						1 3	
2. AMENDMENT/MODIFICATION NO.		3. EFFECTIVE DATE		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO. (If applicable)	
003		11/25/2013		PR-ORD-14-00228			
6. ISSUED BY		CODE		7. ADMINISTERED BY (If other than Item 6)		CODE	
CPOD							
US Environmental Protection Agency							
26 West Martin Luther King Drive							
Mail Code: NWD							
Cincinnati OH 45268							
8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)				(x) 9A. AMENDMENT OF SOLICITATION NO.			
TETRA TECH EM INC							
ATTN (b)(4)				9B. DATED (SEE ITEM 11)			
1881 CAMPUS COMMONS DRIVE							
SUITE 200							
(b)(4)				x 10A. MODIFICATION OF CONTRACT/ORDER NO.			
RESTON VA 201911519				EP-C-11-037			
				0003			
CODE (b)(4)				10B. DATED (SEE ITEM 13)			
FACILITY CODE				08/28/2012			
<b>11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS</b>							
<input type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers <input type="checkbox"/> is extended. <input type="checkbox"/> is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.							
12. ACCOUNTING AND APPROPRIATION DATA (If required)				Net Increase: \$7,300.49			
See Schedule							
<b>13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.</b>							
CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.						
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).						
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:						
X	D. OTHER (Specify type of modification and authority) FAR 52.242-3 and Mutual Agreement between the Parties						
E. IMPORTANT: Contractor <input checked="" type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.							
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)							
Tax ID Number: (b)(4)							
DUNS Number:							
The purpose of this modification is to increase and fund the Task Order ceiling to cover the final invoice and trailing costs.							
TOPO: William Yelverton							
LIST OF CHANGES:							
Reason for Modification : Funding Only Action							
Total Amount for this Modification: \$7,300.49							
Continued ...							
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.							
15A. NAME AND TITLE OF SIGNER (Type or print)				16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)			
				Camille W. Davis			
15B. CONTRACTOR/OFFEROR		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA		16C. DATE SIGNED	
(Signature of person authorized to sign)				(Signature of Contracting Officer)		11/25/2013	

## CONTINUATION SHEET

REFERENCE NO. OF DOCUMENT BEING CONTINUED

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NAME OF OFFEROR OR CONTRACTOR

TETRA TECH EM INC

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	<p>New Total Amount for this Award: \$178,145.49</p> <p>Incremental Funded Amount changed From: \$170,845.00 To: \$178,145.49</p> <p>CHANGES FOR LINE ITEM NUMBER: 1 Total Amount changed from \$170,845.00 to \$178,145.49</p> <p>NEW ACCOUNTING CODE ADDED: Account code: 13-14-C-261E000-301FK8XPW-2532--26A6F-14261EC401-0 01 Beginning FiscalYear 13 Ending Fiscal Year 14 Fund (Appropriation) C Budget Organization 261E000 Program (PRC) 301FK8XPW Budget (BOC) 2532 Job # (Site/Project) Cost Organization 26A6F DCN-LineID 14261EC401-001 Quantity: (b)(4) Amount: \$ Cost: \$ Fee: \$ 00.00</p> <p>The revised cost break-out for the task order is as follows: Cost: (b)(4) Fee: \$ TOTAL: \$178,145.49 Delivery: 10 Days After Award Delivery Location Code: CPOD CPOD US Environmental Protection Agency Cincinnati Procurement Op. Division 26 West Martin Luther King Drive Cincinnati OH 45268 USA</p> <p>Payment: RTP Finance Center US Environmental Protection Agency RTP-Finance Center (D143-02) 109 TW Alexander Drive Durham NC 27711</p> <p>FOB: Destination Continued ...</p>				

REFERENCE NO. OF DOCUMENT BEING CONTINUED  
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ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Period of Performance: 08/28/2012 to 12/31/2013				

**PERFORMANCE WORK STATEMENT  
STREAMS II  
Task Order 0003, Tetra Tech EP-C-11-037**

**TITLE:** Thriving with Coal in an Environmentally-Constrained World

<b>Task Order Manager (TOM)</b>	<b>Alternate Task Order Manager (ATOM)</b>
Name: William Yelverton	Name: Rebecca Dodder
Office: ORD/NRMRL/APPCD 109 TW Alexander Dr. RTP, NC 27711	Office: ORD/NRMRL/APPCD 109 TW Alexander Dr. RTP, NC 27711
Phone: 919-541-9737	Phone: 919-541-5376
Fax: 919-541-7885	Fax: 919-541-7885
Email: <a href="mailto:Yelverton.William@epa.gov">Yelverton.William@epa.gov</a>	Email: <a href="mailto:Dodder.Rebecca@epa.gov">Dodder.Rebecca@epa.gov</a>

**PERIOD OF PERFORMANCE:** August 28, 2012 through September 30, 2012

**BACKGROUND**

The negative environmental impacts associated with the use of coal as a primary energy source for electricity generation are well known. Combustion byproducts from a traditional pulverized coal-fired (PC) power plant include pollutants such as oxides of sulfur (SO<sub>x</sub>) and nitrogen (NO<sub>x</sub>), particulate matter (PM), ash and mercury (Hg), which have been implicated as sources of various adverse health effects. While measures have been taken, and numerous mature control options exist, to greatly reduce the amount of these emissions, attention has turned to the large amounts of carbon dioxide (CO<sub>2</sub>) released from these facilities. An increase in atmospheric CO<sub>2</sub>, the most abundant and thus most influential greenhouse gas (GHG) has been associated with rises in global mean temperature. It is estimated that reductions in anthropogenic GHG emissions would need to be reduced on the order of 50% to 80% from 2000 levels in order to avert unsustainable changes in climate (IPCC 2007), and achieving such reductions will require a revolution in how energy is produced and used (IEA 2009), likely including measures such as increased energy efficiency and the production of low-carbon energy.

A large portion of U.S. CO<sub>2</sub> emissions result from the use of coal, 35% among major fuel types, yet it is a very important part of our current energy mix, accounting for 45% of domestic electricity production in 2010 (EIA, 2011). Not only is it inexpensive, it is also an extremely reliable, abundant, and – perhaps most importantly – domestic source of fuel. Because of this many industries, and as a result many U.S. jobs, rely on coal. This dependence is especially prominent in EPA Region 8 (R8), which accounts for roughly half of all US coal production (EIA, 2011) and where in 2011 coal was the energy source for 70% of total electric power industry production (EIA, 2012).

Future regulations on CO<sub>2</sub> emissions are widely projected to have major impacts on existing and the prospects for new traditional PC facilities, requiring that emissions from coal use be virtually eliminated in order to meet GHG mitigation goals. Options to control CO<sub>2</sub> emissions directly from coal-fired units are being investigated, but many near term solutions can be costly in terms of price and efficiency penalty. There are alternative means for utilizing our abundant U.S. coal reserves; however the economic production of low-carbon energy from this domestic resource may require a shift in the way it is currently used.

Technologies currently exist to utilize coal in the production of transportation fuels such as gasoline and diesel. It has been suggested that these technologies could be combined with electricity production at a single facility, resulting in a process that makes more efficient use of the coal inputs than traditional PC facilities. Further, co-processing of biomass with CO<sub>2</sub> capture and storage (CCS) could be added to drastically reduce, and possibly eliminate, any CO<sub>2</sub> emissions from the process (Liu, et.al. 2011). If implemented as part of a comprehensive energy production mix, such a strategy could enable the offset of foreign oil imports for use in transportation fuel production while making use of the abundant supply of U.S. coal to produce low- or zero-carbon forms of energy. This would be especially beneficial in R8 as it could allow for low CO<sub>2</sub> sustainment of coal utilization and production in the region.

While there appears to be much potential benefit from such systems in R8, many questions need to be answered. What are the actual costs to site and construct such a system? How would the impacts and complexities relative to the supply of adequate biomass be overcome in a region with few existing local resources? What are the operational costs, requirements, logistics, etc.? What is the market for its products, including captured CO<sub>2</sub>? These are some of the questions this project intends to answer, with the ultimate goal being a detailed blueprint for the turn-key development of such a system in R8.

## **OBJECTIVE**

While conducting Tasks 2 through 4 below, the contractor should consider that the ultimate goal is to provide a detailed plan of how a system utilizing coal and biomass to generate low- or zero-carbon electricity and liquid transportation fuels would be developed in R8 and what steps need be taken to mitigate impacts from the project. Of particular interest is the sustainability of such a facility given the potential for logistical complications with the supply of biomass over time in a region where few native resources exist and there is preference toward not converting land for the purpose of dedicated biomass production. This plan would act as a “turn-key” blueprint for such facilities to be built in R8 either at new sites or via the conversion of existing PC facilities. The final products should be a comprehensive analysis describing how the development of such a facility would be conducted, including all project phases, activities, responsibilities, estimated costs, etc., as well as a report detailing the implications of wide-scale deployment of this technology throughout R8.

## **TASKS**

All Tasks shall be discussed with the TOM during execution and upon completion. Regular updates, via conference call or other means, shall take place as necessary and on a predetermined schedule agreed upon by EPA and contractor personnel following award of the task order. EPA review and approval shall be required before proceeding from one task to the next unless otherwise requested by the TOM.

### **Task 1: Quality Assurance Project Plan (QAPP)**

The contractor shall provide a QAPP as required by Attachment 1 of this Performance Work Statement (PWS). No work shall be initiated until the QAPP has been reviewed and approved by EPA.

Task 1 Deliverable: The contractor shall provide a completed version of the QAPP within four (4) weeks after award of the task order. EPA will submit the document for internal QA review and return it to the contractor as soon as available. The contractor shall address all comments and QA review questions and return a final version of the QAPP within two (2) weeks.

### **Task 2: Site Identification**

The Contractor shall, in collaboration with the TOM, recommend a site within R8 which would be suitable for development of a facility utilizing coal and biomass to produce liquid transportation fuels and

electricity with CCS as well as a sustainable inflow of biomass feedstocks. The facility may either be a greenfield site, where a new facility would be developed, or that of an existing PC power plant which could be converted. Special considerations should be made for those locations where job opportunities in the region will be positively impacted, either via new employment opportunities where needed or salvaged jobs at a location likely to be taken off-line in the near future (e.g. 10-15 years), in conjunction with other considerations such as cost/availability of fuels and product market opportunities. The location chosen will be the basis for a detailed site analysis as discussed in the following Tasks.

**Task 2 Deliverable:** The contractor shall provide a draft technical memorandum describing, in detail, the location of and specific reasoning for its recommendation within four (4) weeks after notification of QAPP approval. EPA will review the recommendations and respond with any comments, questions, etc. within two (2) weeks. The contractor shall address any comments and provide a final technical memorandum within two (2) weeks.

**Task 3: Outline for Site Development Analysis**

The contractor shall provide a written report outlining a recommended plan, including all activities, required to develop a facility in EPA R8 which utilizes coal and biomass to produce liquid transportation fuels and electricity with CCS at the site specified in Task 2. Each phase, section, activity, etc. should be accompanied by a brief description to include information such as preliminary time estimates, costs, and potential obstacles. These descriptions need only to provide a broad overview of the various phases required to develop the facility (e.g. a few sentences for each will likely suffice) as they will be expanded on in Task 4. Examples include but should not be limited to land/site procurement, permitting, grid connection, water requirements, fuel supplies (availability, delivery logistics, contracts, lifespan of fuel supplies under current logistics, etc.), construction (specific by system), product markets/delivery (power purchase agreement[s] for electricity, liquid fuels sales), and CO<sub>2</sub> sale/storage including transport. This plan shall be reviewed and approved by the TOM before proceeding to Task 4.

**Task 3 Deliverable:** The contractor shall provide a draft outline within six (6) weeks of completion of Task 2. EPA will review and respond with any comments, questions, etc. within two (2) weeks. The contractor shall address any comments and provide a final outline within two (2) weeks.

**Task 4: Detailed Site Development Plan**

The contractor shall provide a detailed site analysis recommending a plan for development of the site specified in Task 2. This plan should describe in detail each phase, activity, etc. of the project. Although all aspects noted in the Task 3 deliverable should be addressed, of particular interest would be the details for the following:

- a) A continuous supply of biomass, given that there are little resources in the region and assuming it is preferred that existing lands not be converted for the purpose of dedicated biomass production.
- b) Details of CCS technology including transport of CO<sub>2</sub> to storage or (preferably) enhanced oil recovery (EOR) opportunities.
- c) Estimates of mass, energy, and carbon balances; life cycle GHG emissions and other environmental impacts and analysis of possible uncontrollable land use/value change (N<sub>2</sub> & C cycles).
- d) Fuel and product splits/variations the specific system will be capable of. In essence, would such a system be able to adjust inputs and/or outputs in accordance with market forces to remain economical over time? Also, will the system be able to utilize a wide range of biomass fuels?

Task 4 Deliverable: The contractor shall provide a draft version of the development plan within 12 weeks of completion of Task 3. EPA will review and respond with any comments, questions, etc. within four (4) weeks. The contractor shall address any comments and provide a final outline within four (4) weeks.

#### **Task 5: Summary Report**

The contractor shall provide a summary report detailing particular obstacles, regulatory issues, etc. which would need to be overcome and benefits realized in the wide-scale deployment of such facilities in R8. This would include but not be limited to: biomass supply strategies; opportunities for EOR and CO<sub>2</sub> storage; water resources requirements and supply; GHG and other emissions impacts; employment ramifications; and conditions under which adoption of this technology would be economically advantageous / disadvantageous. The report should address regulatory issues relating to generation of electricity and fuels from these facilities, and how they might participate in future energy strategies for meeting environmental policy objectives. The report should also propose metrics for future projects to determine whether plant logistics are continuing in a manner consistent with low carbon generation goals (e.g., should track actual life cycle carbon, not as a limit, but to inform EPA on current thoughts / assumptions on the topic).

Task 5 is not necessarily dependant on those prior to it in the same manner that it is required that Tasks 2 and 3 shall be completed before moving on to Task 4. Therefore it may be carried out in conjunction with Tasks 2 through 4.

Task 5 Deliverable: The contractor shall provide a draft report by June 24, 2013. EPA will review and respond with any comments, questions, etc. within six (6) weeks. The contractor shall address any comments and provide a final report by September 16, 2013.

### **OTHER DELIVERABLES**

#### Progress Review Meetings

A kick off meeting will be held, via teleconference, within two (2) weeks after award of the Task Order.

Bi-monthly progress review meetings shall be conducted to discuss project status, issues, etc. with interim communication held as often as needed. Prior to the regularly-scheduled meetings, the contractor shall prepare a briefing that reviews the work plan, progress to date, planned approach and activities for the remainder of the project.

The contractor shall prepare a summary of the project meetings and submit the summary to the EPA TOM within five (5) working days after the meetings.

### **REFERENCES**

IPCC (2007) Climate Change 2007: Synthesis report – contribution of working groups 5 I, II and III. In Pachauri RK, Reisinger A (eds) Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Geneva, Switzerland.

IEA (2009) Launching an energy revolution in a time of economic crisis: The case for a low-carbon energy technology platform. La Maddelena to L'Aquila G8 Summit. International Energy Agency: Paris, France

EIA (2011) What is the Role of Coal in the United States?. Updated May, 27 2011.  
[http://www.eia.gov/energy\\_in\\_brief/role\\_coal\\_us.cfm](http://www.eia.gov/energy_in_brief/role_coal_us.cfm)

EIA (2012) Electric Power Monthly. Electric Power Data by Month and State, 2001 to the Present: Net Generation by State by Type of Producer by Energy Source. <http://205.254.135.24/electricity/monthly/>

Lu G, Larson ED, Williams RH, Kreutz TG, Guo X (2011) Making Fischer-Tropsch Fuels and Electricity from Coal and Biomass: Performance and Cost Analysis. *Energy Fuels* 2011, 25:415-437

## **Attachment 1**

### **QAPP REQUIREMENTS FOR REGION 8 RARE GRANT PROJECT (Thriving with Coal in an Environmentally-Constrained World)**

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**GENERAL REQUIREMENTS:** Include cover page, distribution list, approvals, and page numbers.

#### **0. COVER PAGE**

Include the project title, revision number, EPA technical lead, EPA division/branch, QA category, organization responsible for QAPP preparation, and date.

#### **1. PROJECT DESCRIPTION AND OBJECTIVES**

- 1.1 Describe the objectives of the project and the general process to attain the objectives.
- 1.2 Describe the technology that will be used to convert coal and biomass into liquid transportation fuels and electricity and to capture carbon from the coal and biomass. Describe the current development stage of the technology. Describe the important characteristics of the physical facility/site at which the technology will be deployed.
- 1.3 Identify the technical, environmental, logistical, legal, and economic characteristics of the facility/site that have a bearing on the successful deployment of the technology. Examples of such characteristics are Biomass supply, CCS technology, balances of mass, energy, and carbon, fuel and product splits, land/site procurement, permitting, grid connection, water requirements, fuel supplies (delivery logistics, contracts, etc.), construction (specific by system), product markets/delivery (power purchase agreement[s] for electricity, liquid fuels sales), and CO<sub>2</sub> sale/storage including transport.
- 1.4 Describe the detailed site development plan that will be prepared, including how the development of such a facility/site would be conducted, how the plan will analyze the facility/site characteristics that are identified and how decisions will be reached regarding the feasibility of the facility/site for successful technology deployment.

#### **2. ORGANIZATION AND RESPONSIBILITIES**

- 2.1 Identify all project personnel, including independent QA personnel, for each participating organization, and their roles and responsibilities as well as their relationships to other project participants.
- 2.2 Include a project schedule that includes key milestones.

#### **3. ENGINEERING APPROACH**

- 3.1 Identify the specific information, including secondary (existing) data, that is needed to analyze the facility/site characteristics. If applicable, identify specific information as being critical or non-critical to meeting the objectives of the project
- 3.2 Specify any requirements (e.g., time periods, applicability to project, and technological similarity) for the information.
- 3.3 Identify the potential source(s) for the information. Discuss the rationale for selecting the source(s) identified. If a hierarchy of sources exists for the gathering of information, specify that hierarchy. Specify that the source(s) will be documented in the detailed site development plan.
- 3.4 Describe the process for analyzing the information and for making decisions about the facility/site development to meet the project objectives, including how this process will be documented.

## **Attachment 1**

### **4. QUALITY METRICS**

- 4.1 Specify the quality metrics for the information, including adequacy for decision-making purposes, source authority, relevance, accuracy, consistency, completeness, and currency, if applicable.
- 4.2 Describe the qualitative or quantitative procedures for assessing the quality of the information, including how assessment results will be documented in the detailed site development plan. Assessment criteria may be strict accept/reject criteria or graduated criteria.
- 4.3 Describe how the assessment results will influence the subsequent use of the data.

### **5. DATA MANAGEMENT**

- 5.1 Describe information storage requirements for both hard copy and electronic data.

### **6. REPORTING**

- 6.1 Describe the project deliverables, including the expected content of the detailed site development plan.
- 6.2 Discuss the expected distribution of the project deliverables.

### **7. REFERENCES**

Provide references either in the body of the text as footnotes or in a separate section.